GROUP 17

ENGINE AND EMISSION CONTROL

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ENGINE CONTROL

GENERAL INFORMATION

M1171000100556

For the accelerator system, an electronic throttle actuator control system without the accelerator cable is used.

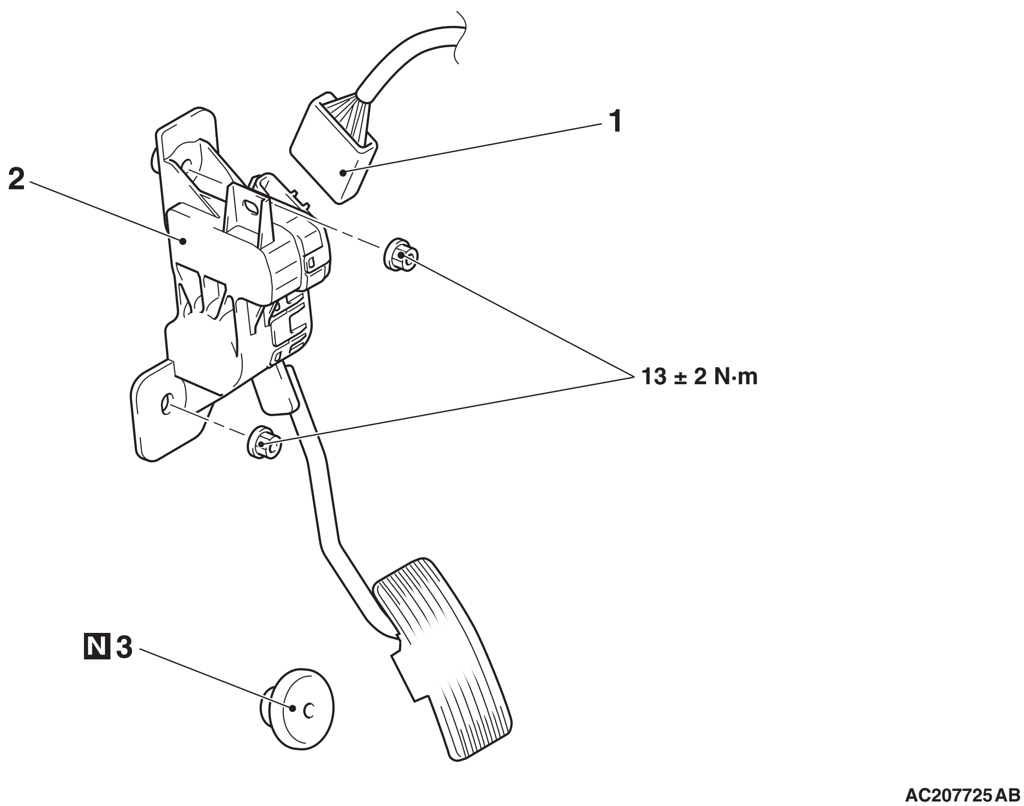
ACCELERATOR PEDAL

REMOVAL AND INSTALLATION

M1171003000354

⚠ CAUTION

- **Never loosen the screw fixing the accelerator pedal assembly resin cover. If the screw is loosened, the sensor position which exists inside the resin cover is off and the accelerator pedal position sensor does not work normally.**
- **Do not remove the accelerator pedal pad. If the pad is removed and installed, excessive force may damage accelerator pedal position sensor.**



Removal steps

1. Accelerator pedal position sensor connector

Removal steps (Continued)

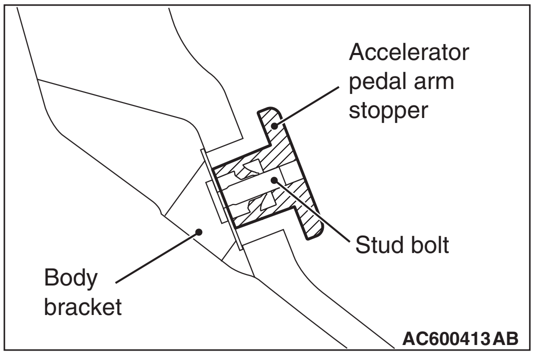
2. Accelerator pedal assembly

>>A<< 3. Accelerator pedal arm stopper

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INSTALLATION SERVICE POINT

>>A<< ACCELERATOR PEDAL ARM STOPPER INSTALLATION



1. Insert the accelerator pedal arm stopper straight into the stud bolt of the floor.
2. Install the accelerator pedal arm stopper securely by turning it clockwise until its underside contacts with the body bracket as shown in the figure.
3. After the installation, slightly pull the accelerator pedal arm stopper by hand to check that it cannot be removed easily (appropriate holding power: 100N or more).

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EMISSION CONTROL

GENERAL INFORMATION

M1173000100938

The emission control system consists of the following subsystems:

- Crankcase emission control system
- Evaporative emission control system
- Exhaust emission control system

Items	Name	Specification
Crankcase emission control system	Positive crankcase ventilation (PCV) valve	Variable flow type (Purpose: HC reduction)
Evaporative emission control system	Canister Purge control solenoid valve	Equipped Duty cycle type solenoid valve (Purpose: HC reduction)
Exhaust emission control system	Air-fuel ratio control device - MPI system	Oxygen sensor feedback type (Purpose: CO, HC, NOx reduction)
	Exhaust gas recirculation system <4A9-CVT> • EGR valve	Equipped Stepper motor type (Purpose: NOx reduction)
	Catalytic converter	Monolith type (Purpose: CO, HC, NOx reduction)

EMISSION CONTROL DEVICE REFERENCE TABLE

M1173006600458

Related parts	Crankcase emission control system	Evaporative emission control system	Air/fuel ratio control system	Catalytic converter	Exhaust gas recirculation system
PCV valve	×				
Purge control solenoid valve		×			
MPI system component		×	×		
Catalytic converter				×	
EGR valve (stepper motor) <4A9-CVT>					×

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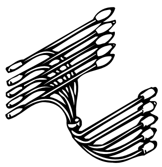
SERVICE SPECIFICATIONS

M1173000300772

Items	Standard value
Purge control solenoid valve coil resistance (at 20°C) Ω	30 – 34
EGR valve coil resistance (at 20°C) Ω <4A9-CVT>	20 – 24

SPECIAL TOOL

M1173000600557

Tool	Number	Name	Use
 MB991658	MD991658	Test harness	EGR valve (stepper motor) check <4A9-CVT>

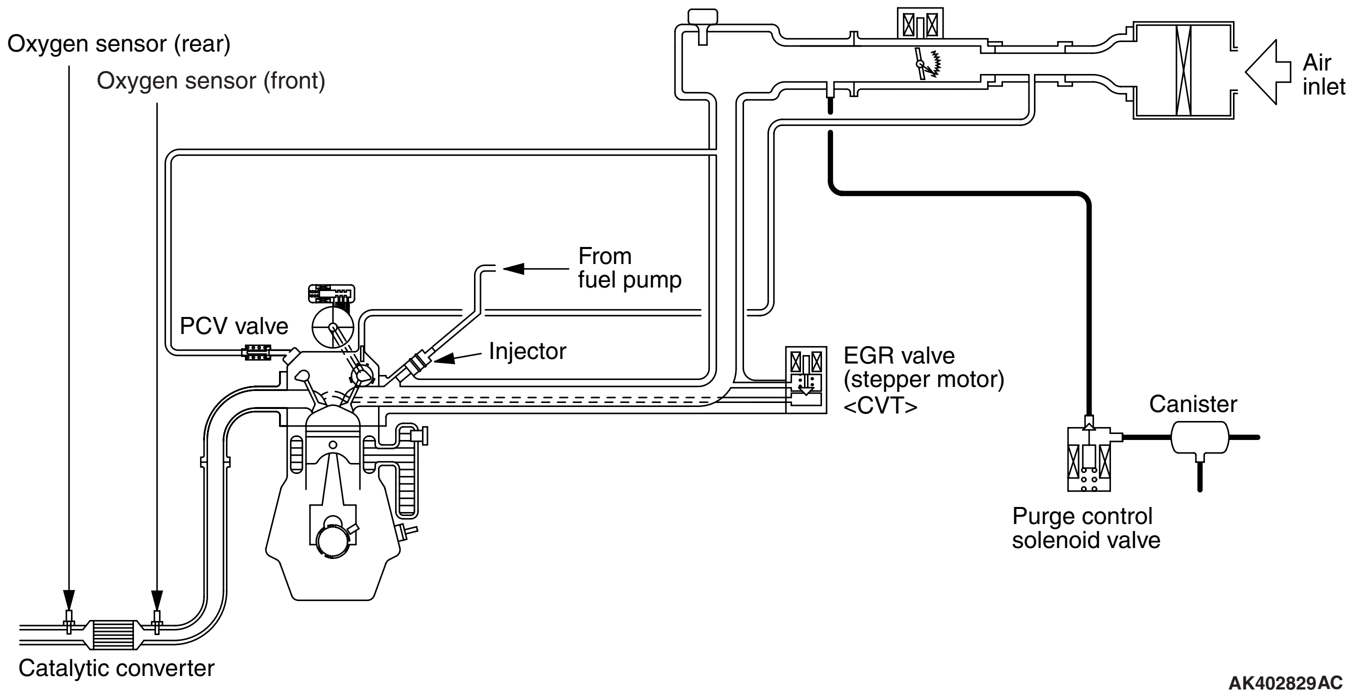
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VACUUM HOSE

VACUUM HOSE PIPING DIAGRAM

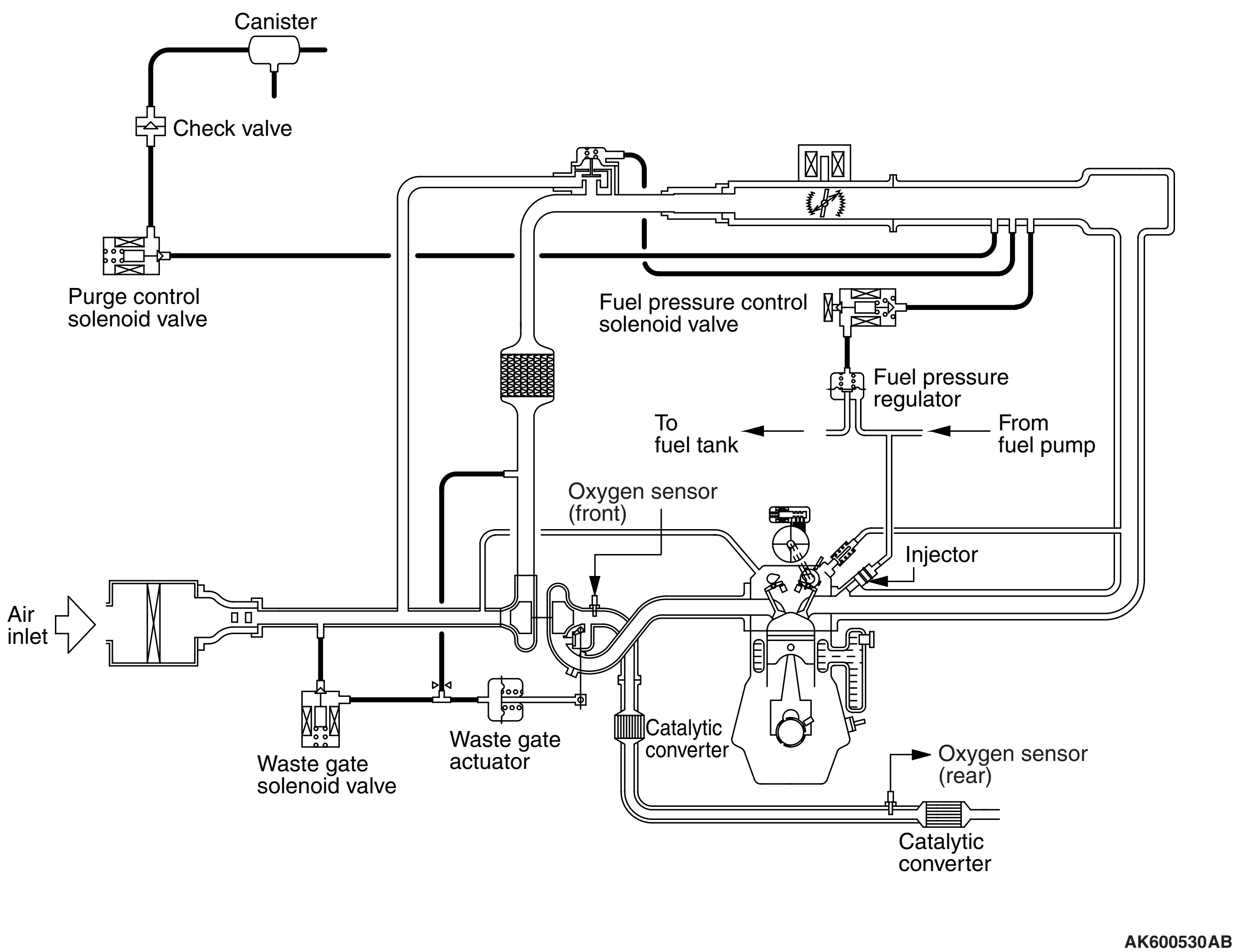
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<4A9>



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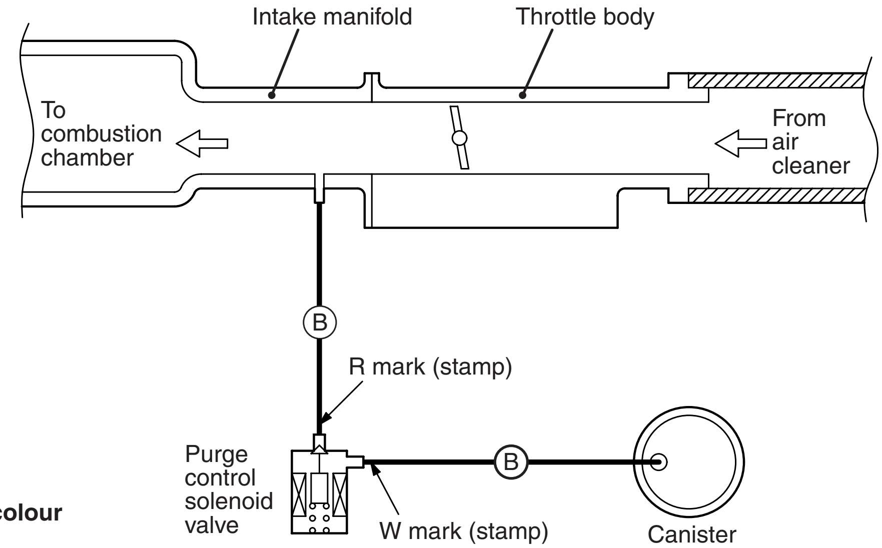


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VACUUM CIRCUIT DIAGRAM

M1173007100702

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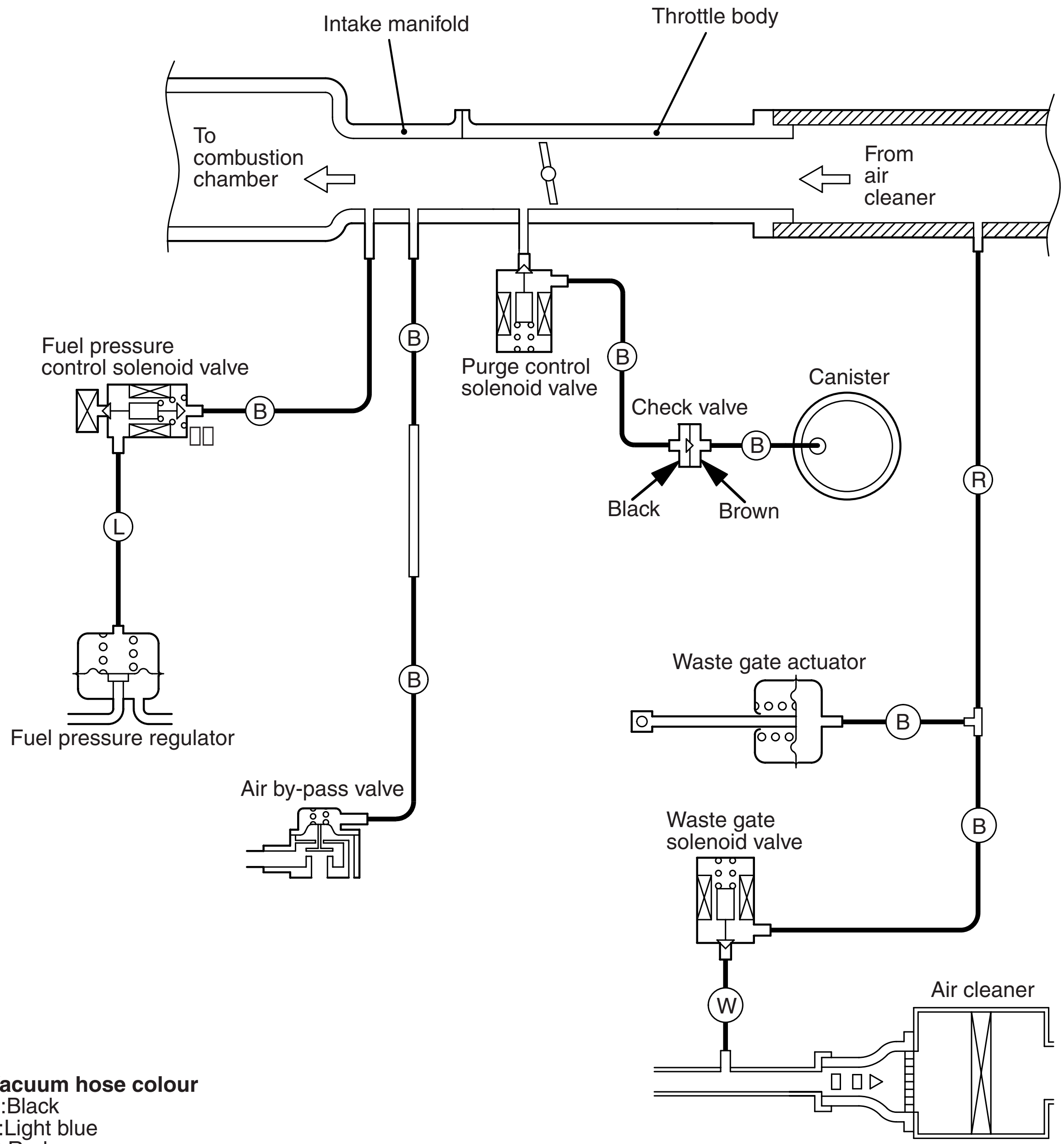


Vacuum hose colour
B: Black

AK304617AB

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<4G1>



Vacuum hose colour
B:Black
L:Light blue
R:Red
W:White

AK402415AB

VACUUM HOSE CHECK

M1173007300397

1. Using the piping diagram as a guide, check to be sure that the vacuum hoses are correctly connected.
2. Check the connection condition of the vacuum hoses, (removed, loose, etc.) and check to be sure that there are no bends or damage.

VACUUM HOSE INSTALLATION

M1173007200312

1. When connecting the vacuum hoses, they should be securely inserted onto the nipples.
2. Connect the hoses correctly, using the vacuum hose piping diagram as a guide.

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CRANKCASE EMISSION CONTROL SYSTEM

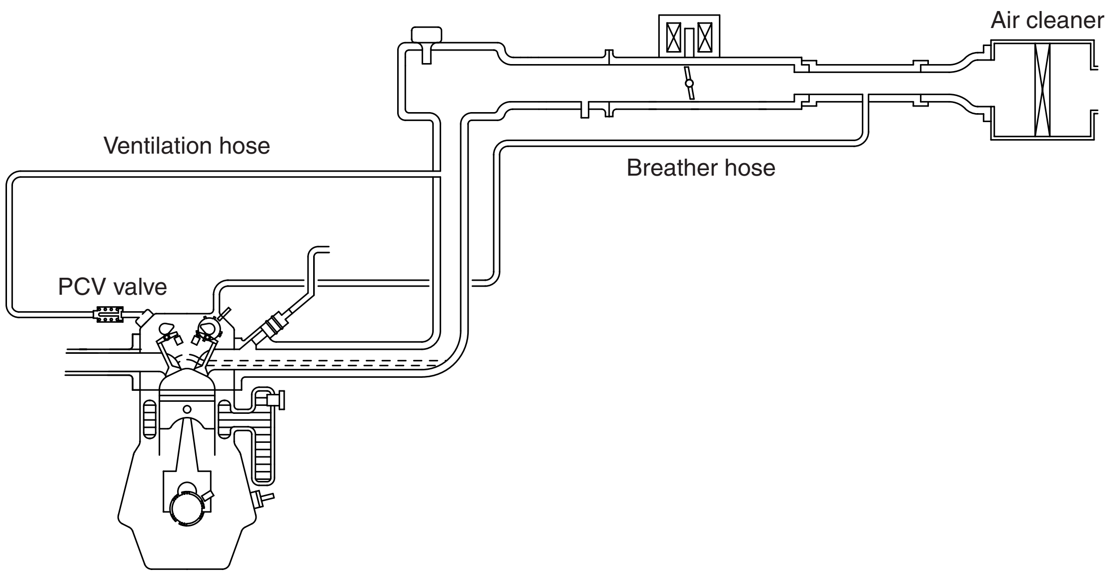
GENERAL INFORMATION (CRANKCASE EMISSION CONTROL SYSTEM)

M1173005000817

The crankcase emission control system prevents blow-by gases from escaping inside the crankcase into the atmosphere.
Fresh air is sent from the air cleaner into the crankcase through the breather hose.
The air becomes mixed with the blow-by gases inside the crankcase.
The blow-by gas inside the crankcase is drawn into the inlet manifold through the positive crankcase ventilation (PCV) valve.
The PCV valve lifts the plunger according to the inlet manifold vacuum so as to regulate the flow of blow-by gas properly.
In other words, the blow-by gas flow is regulated during low load engine operation to maintain engine stability, while the flow is increased during high load operation to improve the ventilation performance.

SYSTEM DIAGRAM

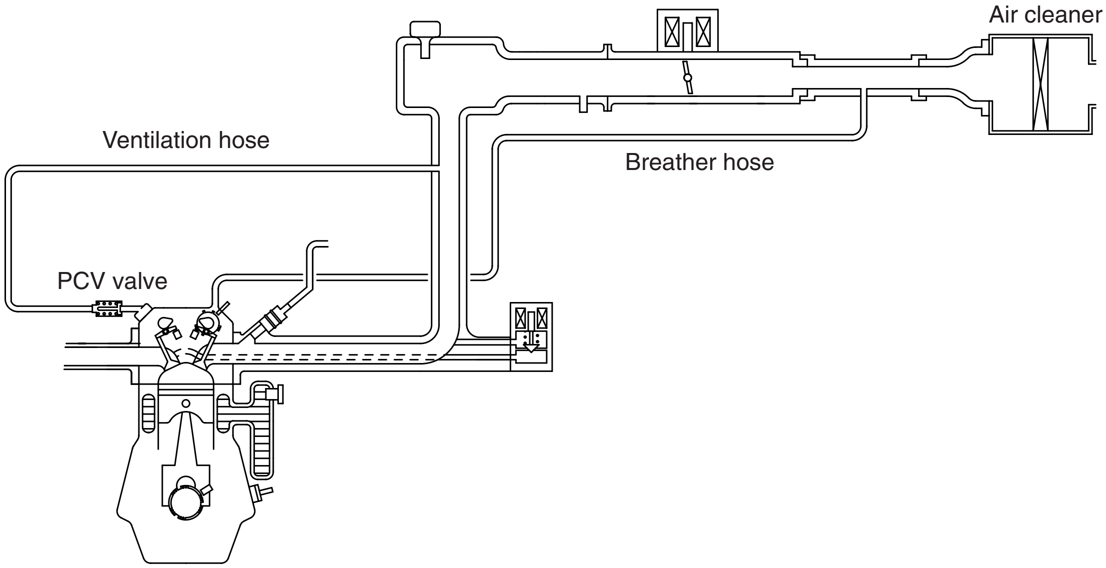
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AK600608AB

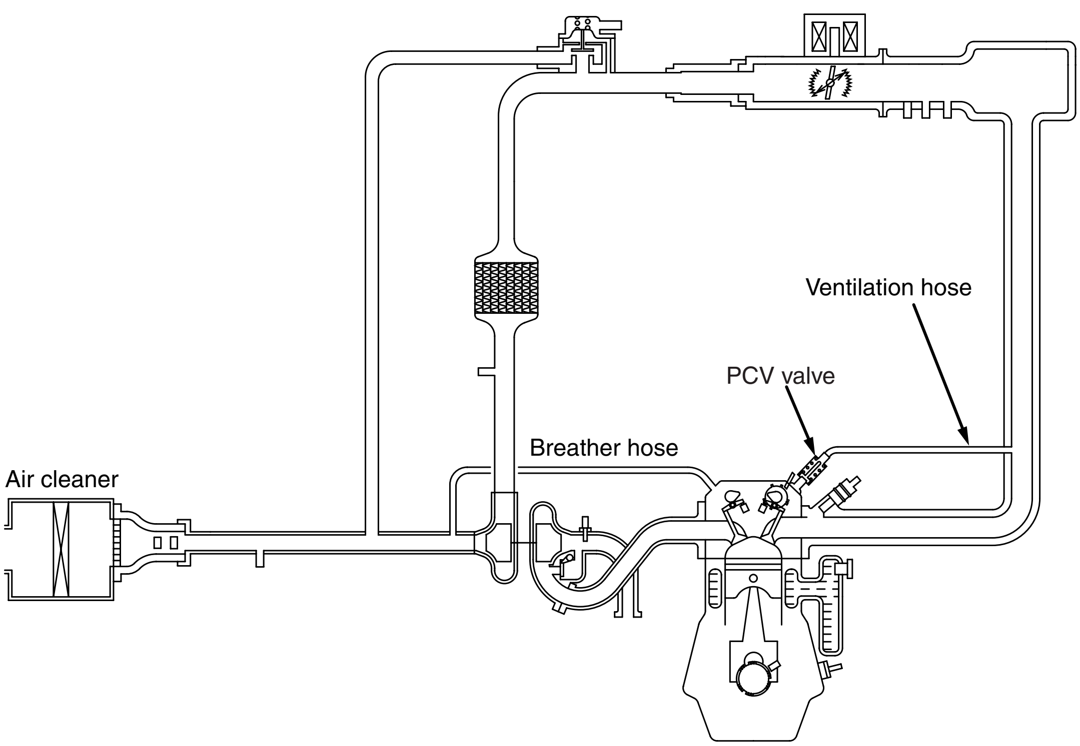
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<4A9-CVT>



AK306105AB

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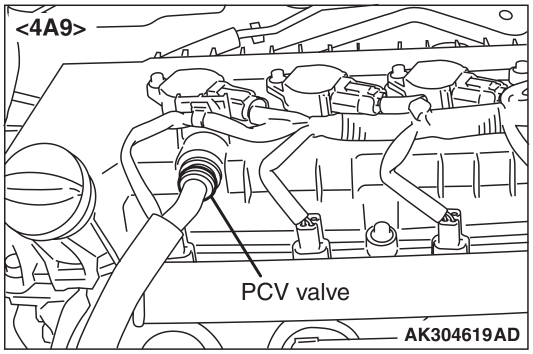


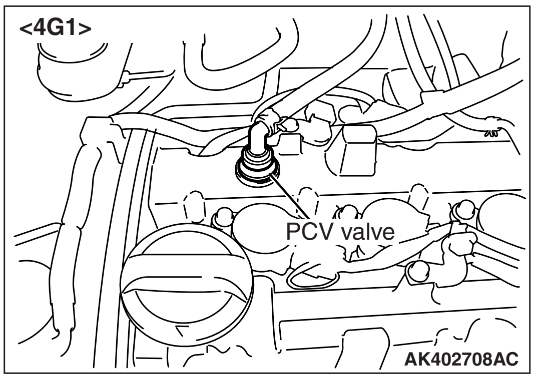
AK401949 AD

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COMPONENT LOCATION (CRANKCASE EMISSION CONTROL SYSTEM)

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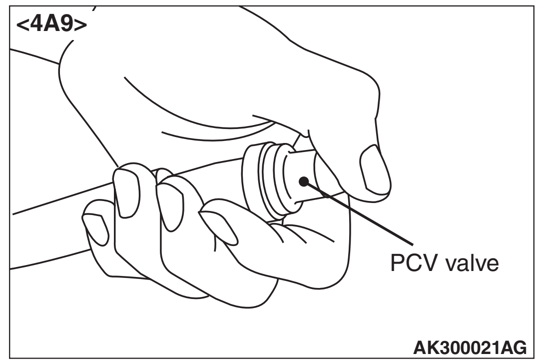


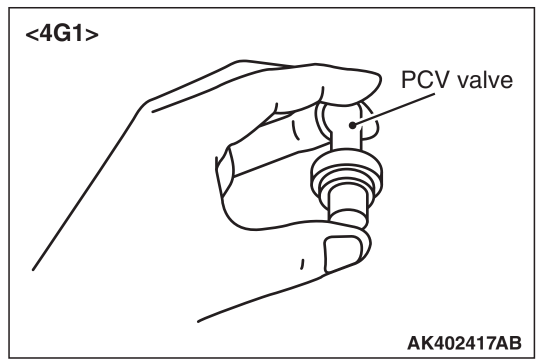


POSITIVE CRANKCASE VENTILATION SYSTEM CHECK

M1173001100566

1. Remove the ventilation hose from the PCV valve.
2. Remove the PCV valve from the rocker cover.
3. Reinstall the PCV valve at the ventilation hose.
4. Start the engine and run at idle.





5. Place a finger at the opening of the PCV valve and check that vacuum of the inlet manifold is felt.

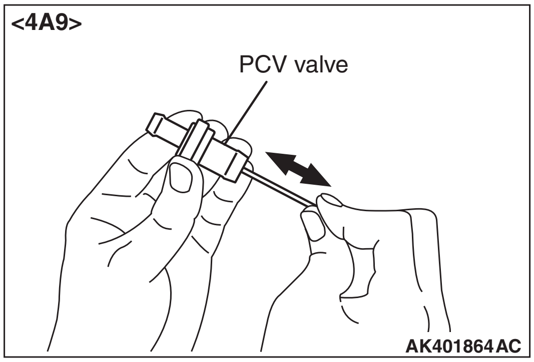
   NOTE: At this moment, the plunger in the PCV valve moves back and forth.

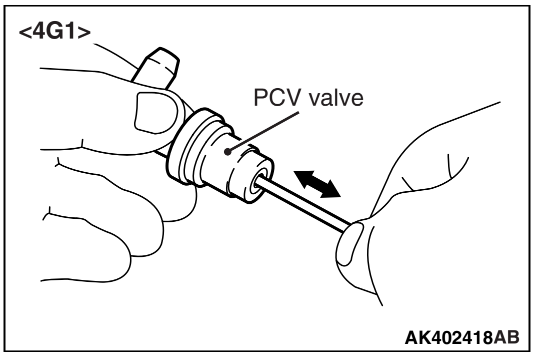
6. If vacuum is not felt, clean the PCV valve or replace it.

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POSITIVE CRANKCASE VENTILATION (PCV) VALVE CHECK

M1173001200518





1. Insert a thin rod into the PCV valve from the side shown in the illustration (rocker cover installation side), and move the rod back and forth to check that the plunger moves.
2. If the plunger does not move, there is a clogging in the PCV valve. In this case, clean or replace the PCV valve.

EVAPORATIVE EMISSION CONTROL SYSTEM

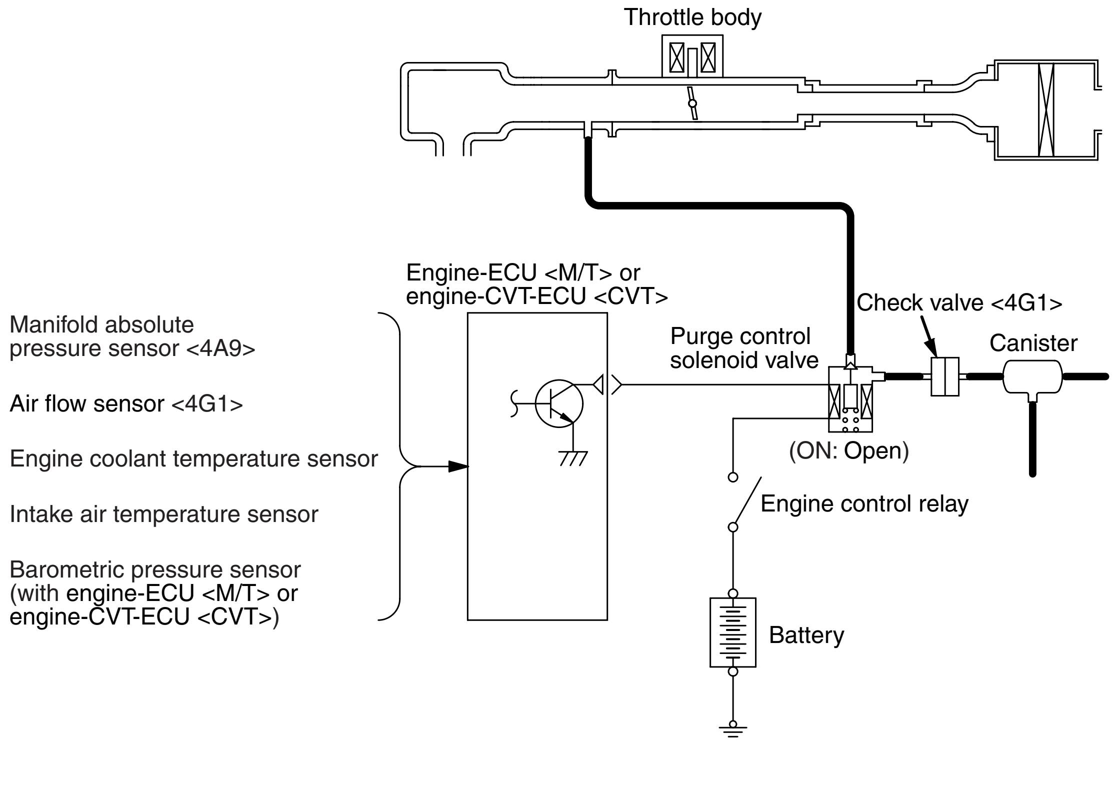
GENERAL INFORMATION (EVAPORATIVE EMISSION CONTROL SYSTEM)

M1173005100955

The evaporative emission control system prevents fuel vapours generated in the fuel tank from escaping into the atmosphere.
Fuel vapours from the fuel tank flow through the fuel tank pressure control valve and vapour pipe/hose to be stored temporarily in the canister.
When driving the vehicle, fuel vapours stored in the canister flow through the purge control solenoid valve and purge port and go into the inlet manifold to be sent to the combustion chamber.
When the engine coolant temperature is low or when the intake air quantity is small (when the engine is at idle, for example), the engine control unit turns the purge solenoid off to shut off the fuel vapour flow to the inlet manifold.
This does not only insure the driveability when the engine is cold or running under low load but also stabilize the emission level.

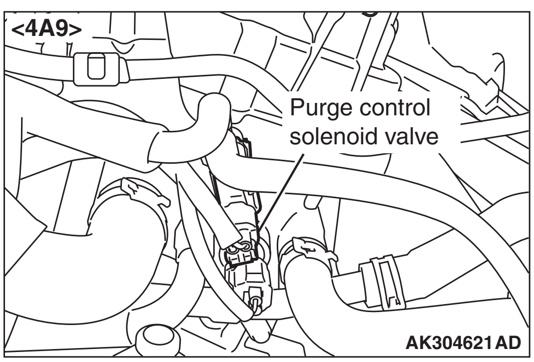
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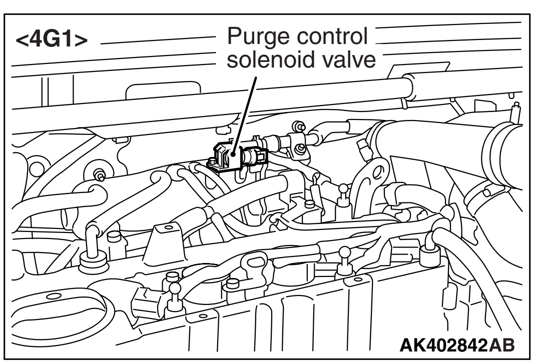
SYSTEM DIAGRAM



COMPONENT LOCATION (EVAPORATIVE EMISSION CONTROL SYSTEM)

M1173007500539



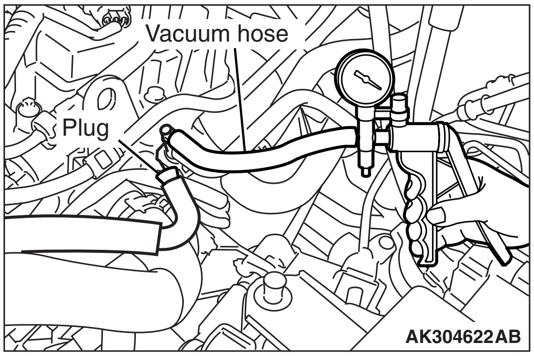


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PURGE CONTROL SYSTEM CHECK

M1173001400879

<4A9>



1. Disconnect the vacuum hose with R-mark (stamp) from purge control solenoid valve and connect a hand vacuum pump to the nipple.
2. Plug the vacuum hose.
3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

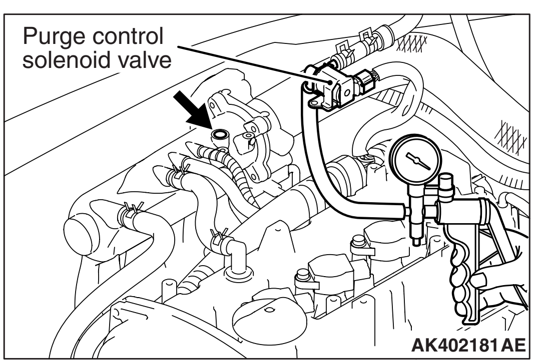
When engine is cold
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained.
3,000 r/min	

When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
At idle	Vacuum is maintained.
3,000 r/min (within 3 minutes after engine starts)	Vacuum will leak.

<4G1>



1. Disconnect the purge control solenoid valve from the inlet manifold and cover the hole with a tape and so on.
2. Connect a hand vacuum pump to the purge control solenoid valve.
3. When the engine is cold or hot, apply a vacuum of 53 kPa, and check the condition of the vacuum.

When engine is cold
(Engine coolant temperature: 40°C or less)

Engine condition	Normal condition
At idle	Vacuum is maintained.
3,000 r/min	

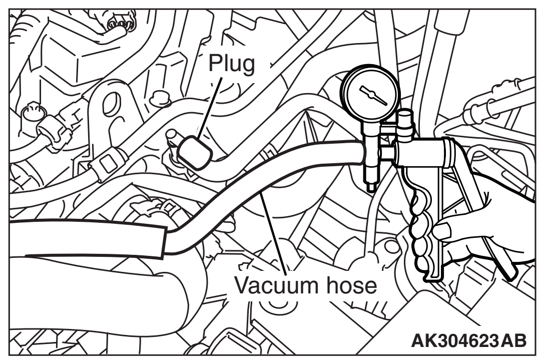
When engine is hot
(Engine coolant temperature: 80°C or higher)

Engine condition	Normal condition
At idle	Vacuum is maintained.
3,000 r/min (within 3 minutes after engine starts)	Vacuum will leak.

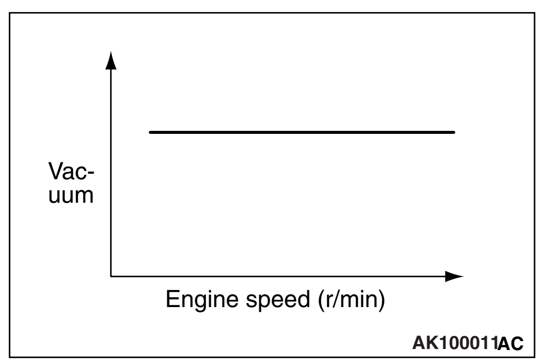
PURGE PORT VACUUM CHECK

M1173001500489

<4A9>

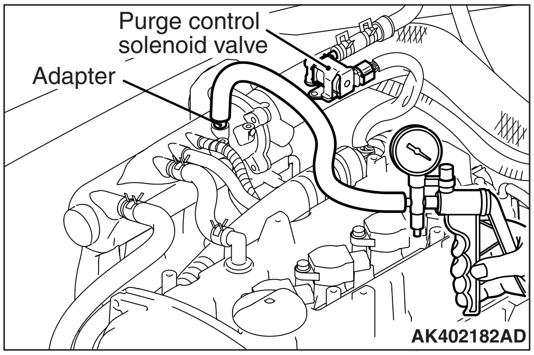


1. Disconnect the vacuum hose with R-mark (stamp) from the purge control solenoid valve and connect it to a hand vacuum pump.
2. Plug the nipple from which the vacuum hose was removed.

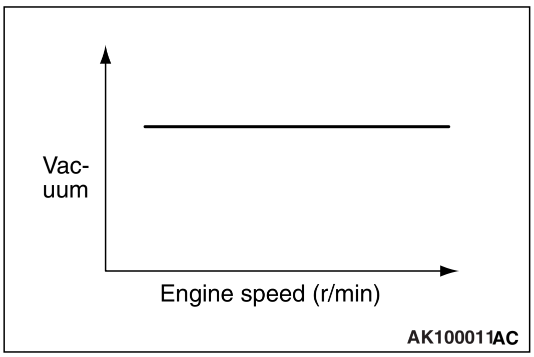


3. Start the engine.
4. Check that a fairly constant negative pressure is generated regardless of the engine speed.
5. If no negative pressure is generated, the port is probably blocked and should be cleaned.

<4G1>



1. Disconnect the purge control solenoid valve from the inlet manifold.
2. Connect the adapter to a hand vacuum pump.
3. Connect the hand vacuum pump to the hole from which the purge control solenoid valve was removed.



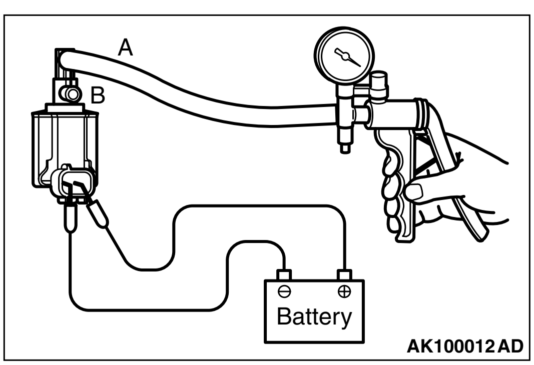
4. Start the engine.
5. Check that a fairly constant negative pressure is generated regardless of the engine speed.
6. If no negative pressure is generated, the port is probably blocked and should be cleaned.

PURGE CONTROL SOLENOID VALVE CHECK

M1173001700568

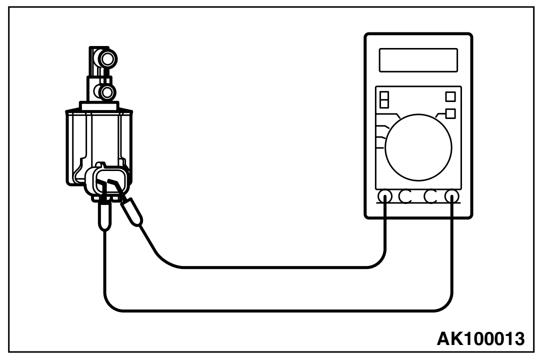
<4A9>

NOTE: When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.



1. Disconnect the vacuum hose from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Battery voltage	nipple (B)	Normal condition
Applied	opened	Vacuum leaks
	closed	Vacuum maintained
Not applied	opened	Vacuum leaks

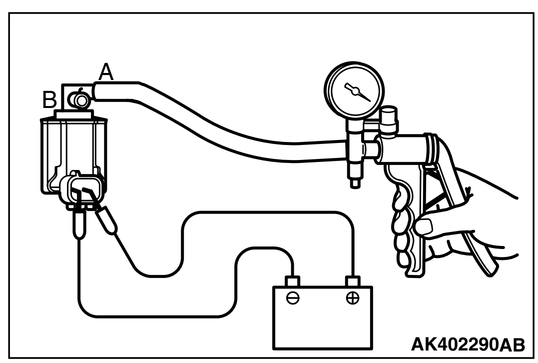


5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 30 – 34 Ω (at 20°C)

<4G1>

NOTE: When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

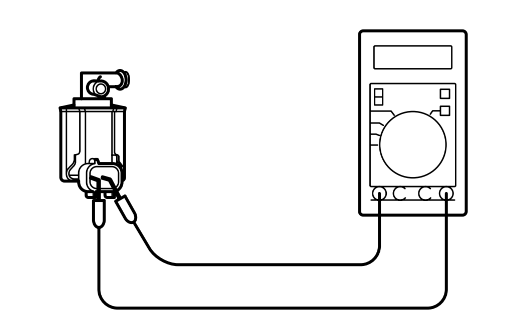


1. Disconnect the purge control solenoid valve from the inlet manifold.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (A) of the solenoid valve (refer to the illustration at left).

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4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the purge control solenoid valve and without applying voltage.

Battery voltage	nipple (B)	Normal condition
Applied	opened	Vacuum leaks
	closed	Vacuum maintained
Not applied	opened	Vacuum leaks



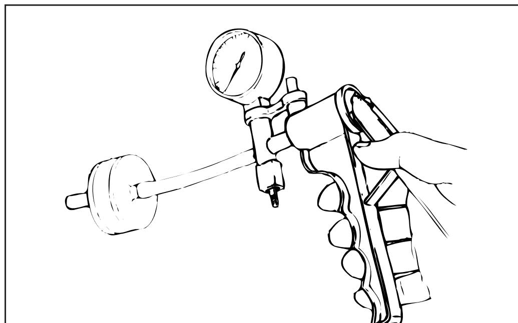
AK402291AB

5. Measure the resistance between the terminals of the solenoid valve.

Standard value: 30 – 34 Ω (at 20°C)

CHECK VALVE CHECK <4G1>

M1173006200182



AK200373

Connect a hand vacuum pump to the check valve, apply negative pressure and check the airtightness.

Connect nipple colour	Normal condition
Black	Negative pressure leaks
Brown	Negative pressure is maintained

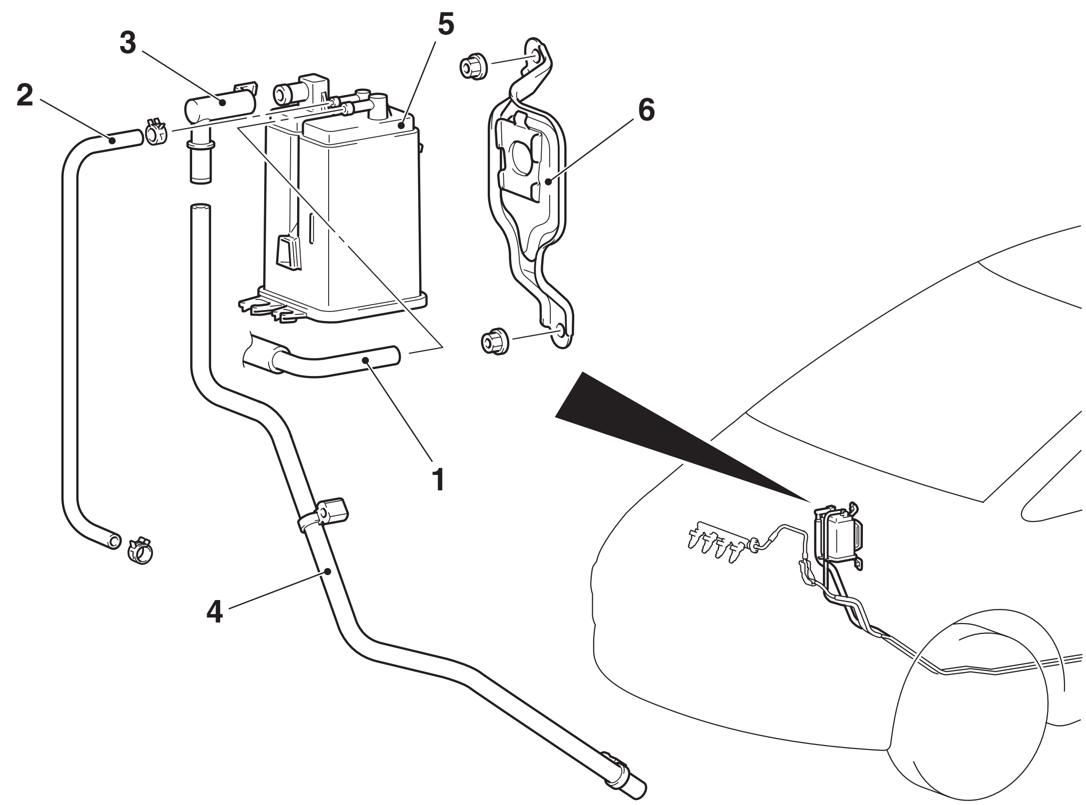
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CANISTER REMOVAL AND INSTALLATION

M1173004200573

Pre-removal and Post-installation Operation
- Air Cleaner assembly Removal and Installation <4A9> (Refer to GROUP 15, Air Cleaner P.15-5).
- Air Cleaner assembly Removal and Installation <4G1> (Refer to GROUP 15, Air Cleaner P.15-6).

<Up tp May 2006 models>



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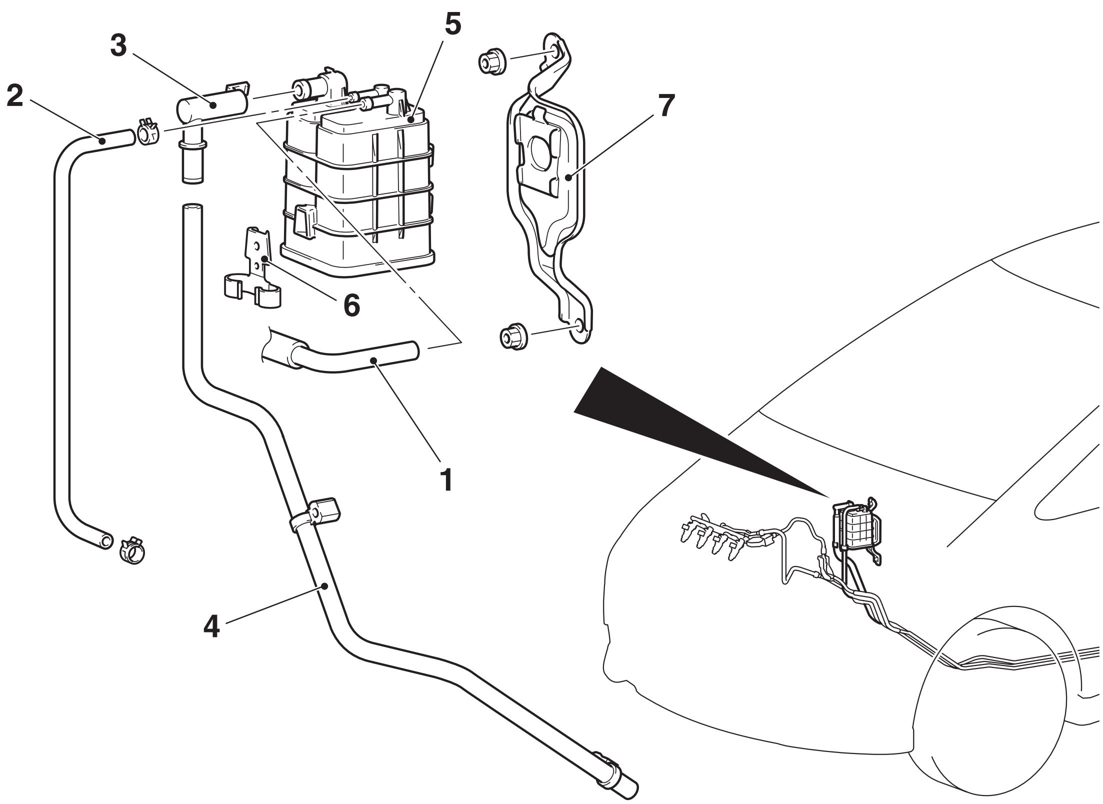
Removal steps
1. Purge hose connection
2. Vapour hose
3. Vent connector

Removal steps (Continued)

4. Vapour hose
5. Canister
6. Canister bracket

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<From Jun. 2006 models>



Removal steps

1. Purge hose connection
2. Vapour hose
3. Vent connector
4. Vapour hose

Removal steps (Continued)

5. Canister
6. Clamp
7. Canister bracket

EXHAUST GAS RECIRCULATION (EGR) VALVE

GENERAL INFORMATION (EGR SYSTEM) <4A9-CVT>

M1173005200822

The exhaust gas recirculation (EGR) system lowers the nitrogen oxide (NOx) emission level.
When the air/fuel mixture combustion temperature is high, a large quantity of nitrogen oxides (NOx) is generated in the combustion chamber.
Therefore, this system recirculates part of emission gas from the exhaust port of the cylinder head to the combustion chamber through the inlet manifold to decrease the air/fuel mixture combustion temperature, resulting in reduction of NOx.
The EGR flow rate is controlled by the EGR valve so as not to decrease the driveability.

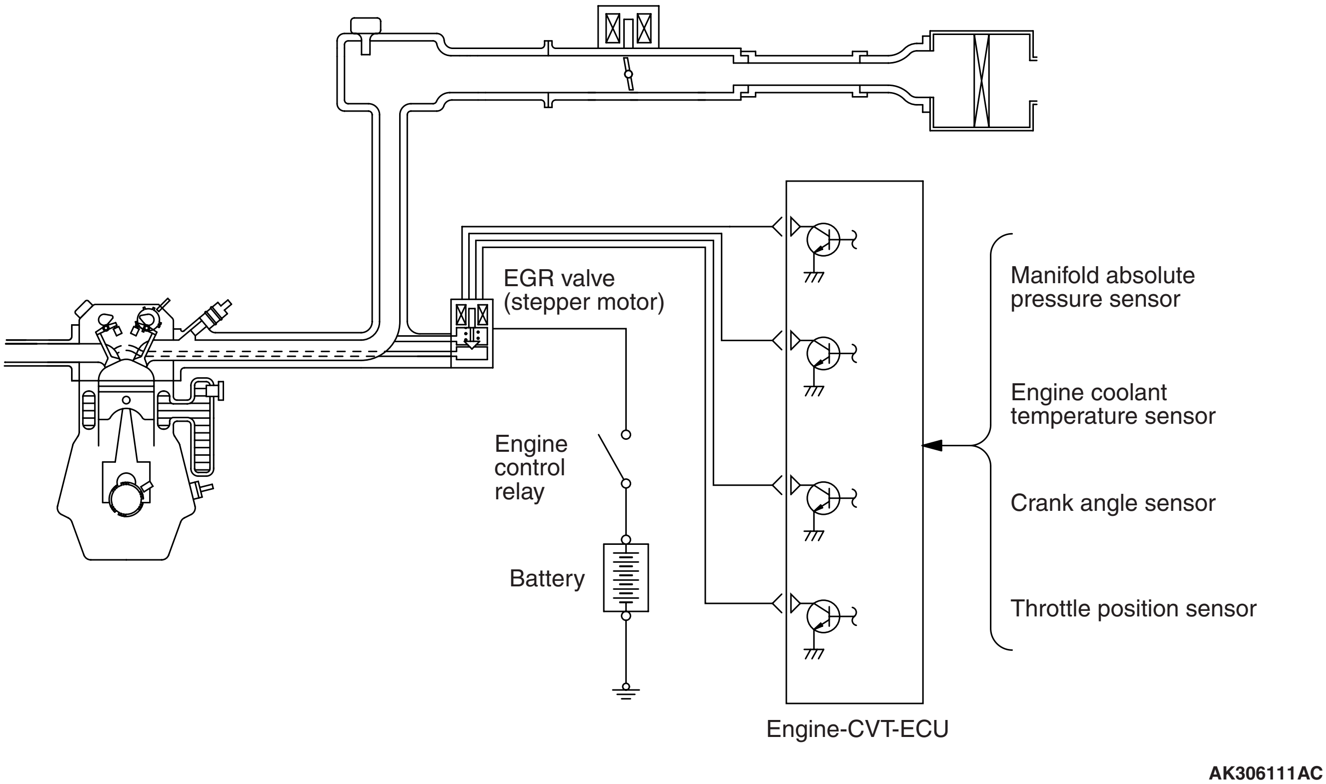
OPERATION

The EGR valve is being closed and does not recirculate exhaust gases under one of the following conditions.
Otherwise, the EGR valve is opened and recirculates exhaust gases.

- The engine coolant temperature is low.
- The engine is at idle.
- The throttle valve is widely opened.

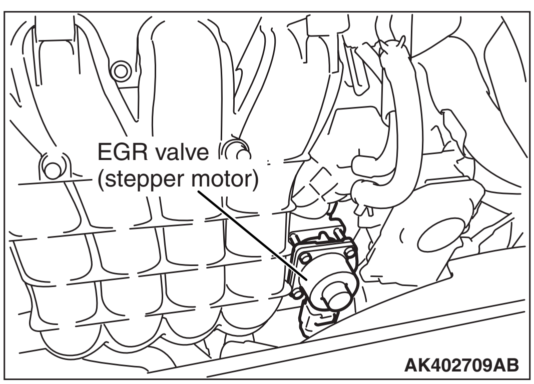
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SYSTEM DIAGRAM



COMPONENT LOCATION (EGR SYSTEM) <4A9-CVT>

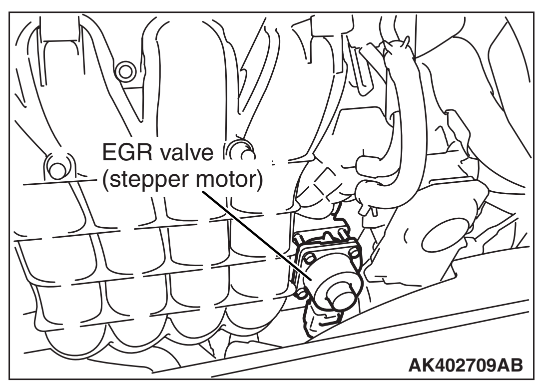
M1173007600503



EGR VALVE (STEPPER MOTOR) CHECK <4A9-CVT>

M1173050200349

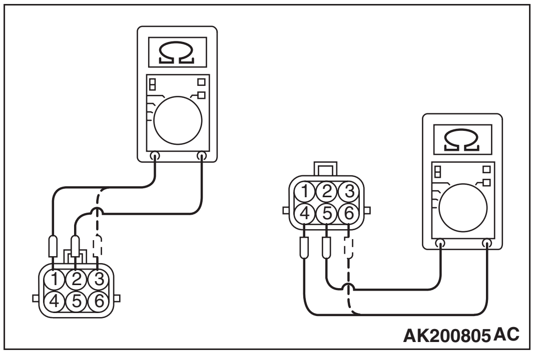
CHECKING THE OPERATION SOUND



1. Check that the operation sound of the stepper motor can be heard from the EGR valve when the ignition switch is turned ON (without starting the engine).
2. If the operation sound cannot be heard, inspect the drive circuit of the stepper motor.

NOTE: If the circuit is normal, either the stepper motor or the engine-CVT-ECU may have failed.

CHECKING THE COIL RESISTANCE



1. Remove the EGR valve.
2. Measure the resistance between terminal No. 2 and either terminal No. 1 or terminal No. 3 of the connector at the EGR valve.

   Standard value: 20 – 24 Ω (at 20°C)

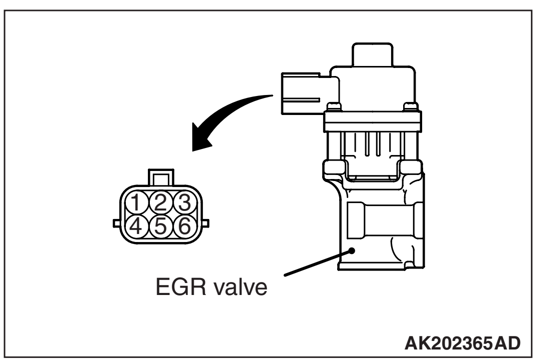
3. Measure the resistance between terminal No. 5 and either terminal No. 6 or terminal No. 4 of the connector at the EGR valve.

   Standard value: 20 – 24 Ω (at 20°C)

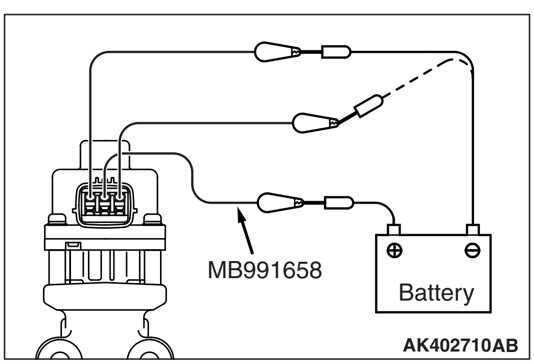
4. Using a new gasket, install the EGR valve by tightening its mounting bolts to the specified torque.

   Tightening Torque: 18 ± 1 N·m

OPERATION CHECK



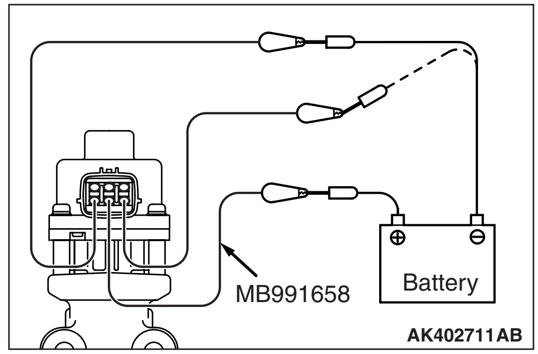
1. Remove the EGR valve.
2. Attach a test wiring harness (special tool MB991658) to the connector at the EGR valve.



⚠ CAUTION

Connecting battery voltage to the EGR valve for a long term could damage the coil.

3. Connect the positive (+) terminal of the battery to terminal No. 2.
4. Connect terminals No. 1 and No. 3 to the negative (-) terminal of the battery, in order to test whether the stepper motor vibrates (with a slight shudder), indicating that the stepper motor is operating.



⚠ CAUTION

Connecting battery voltage to the EGR valve for a long term could damage the coil.

5. Connect the positive (+) terminal of the battery to terminal No. 5.
6. Connect terminals No. 4 and No. 6 to the negative (-) terminal of the battery, in order to test whether the stepper motor vibrates (with a slight shudder), indicating that the stepper motor is operating.
7. If a vibration can be felt during the test, the stepper motor is normal.
8. Using a new gasket, install the EGR valve by tightening its mounting bolts to the specified torque.

   Tightening torque: 18 ± 1 N·m

CLEANING THE EGR VALVE

⚠ CAUTION

Do not use a solvent or detergent, which could enter the motor and cause it to malfunction.

1. Remove the EGR valve and check that the EGR valve is not stuck or clogged with carbon deposits. Use a wire brush to clean the valve if necessary.
2. Using a new gasket, install the EGR valve by tightening its mounting bolts to the specified torque.

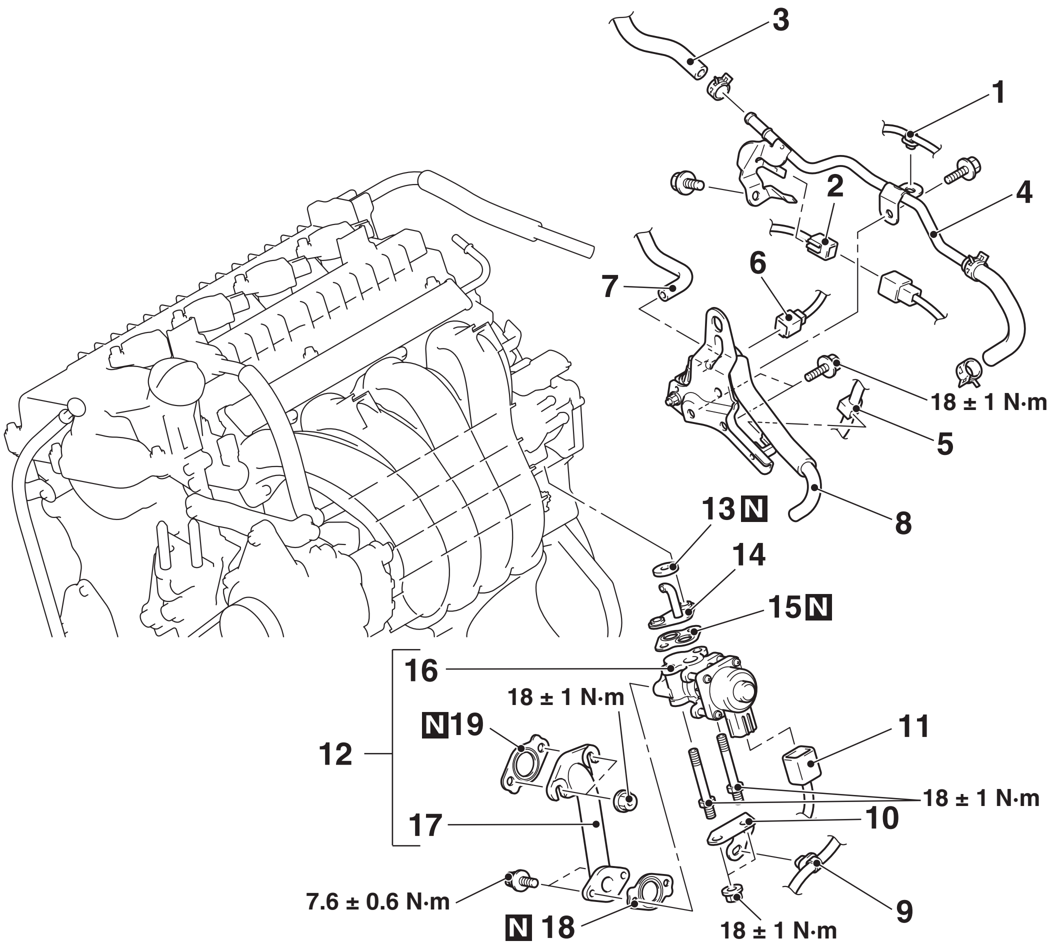
   Tightening torque: 18 ± 1 N·m

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REMOVAL AND INSTALLATION <4A9-CVT>

M1173010500692

Pre-removal and Post-installation Operation
- Air Cleaner Assembly, Air Cleaner Duct Removal and Installation (Refer to GROUP 15, Air Cleaner P.15-5).
- Throttle Body Assembly Removal and Installation (Refer to GROUP13A, Throttle Body P.13A-370).
- Starter assembly Removal and Installation (Refer to GROUP16, Starter P.16-22).



AC601296AB

Removal steps
1. Harness clamp connection
2. Oxygen sensor connector
3. Brake booster vacuum hose connection
4. Brake booster vacuum pipe and brake booster vacuum hose assembly
5. Harness clamp connection
6. Purge solenoid valve connector
7. Purge hose connection
8. Engine hanger, purge solenoid valve and purge solenoid assembly
9. Harness clamp connection

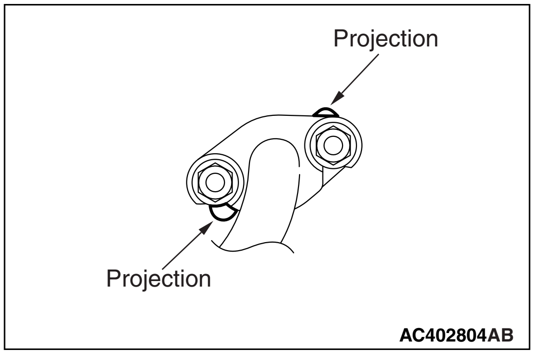
Removal steps (Continued)

10. EGR stay
11. EGR valve connector
12. EGR valve and EGR valve pipe assembly
13. EGR valve gasket
14. EGR equip pipe
15. >>C<< EGR valve gasket
16. EGR valve
17. EGR valve pipe
18. >>B<< EGR pipe gasket B
19. >>A<< EGR pipe gasket A

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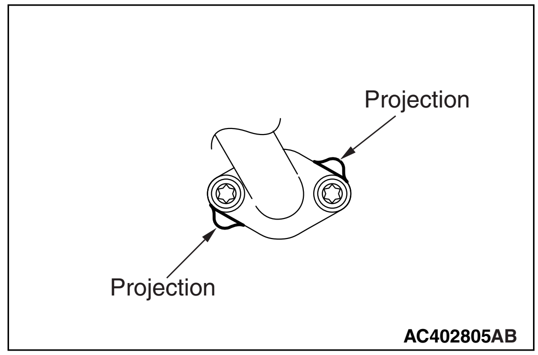
INSTALLATION SERVICE POINTS

>>A<< EGR PIPE GASKET A INSTALLATION



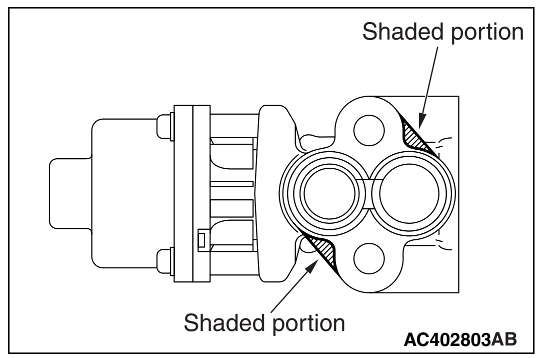
Install the gasket so that its projection is set in the position shown.

>>B<< EGR PIPE GASKET B INSTALLATION



Install the gasket so that its projection is set in the position shown.

>>C<<EGR VALVE GASKET INSTALLATION



Install the EGR valve gasket so that the shaded portion of the gasket is set as shown. Be sure to check which side of the gasket faces outside.

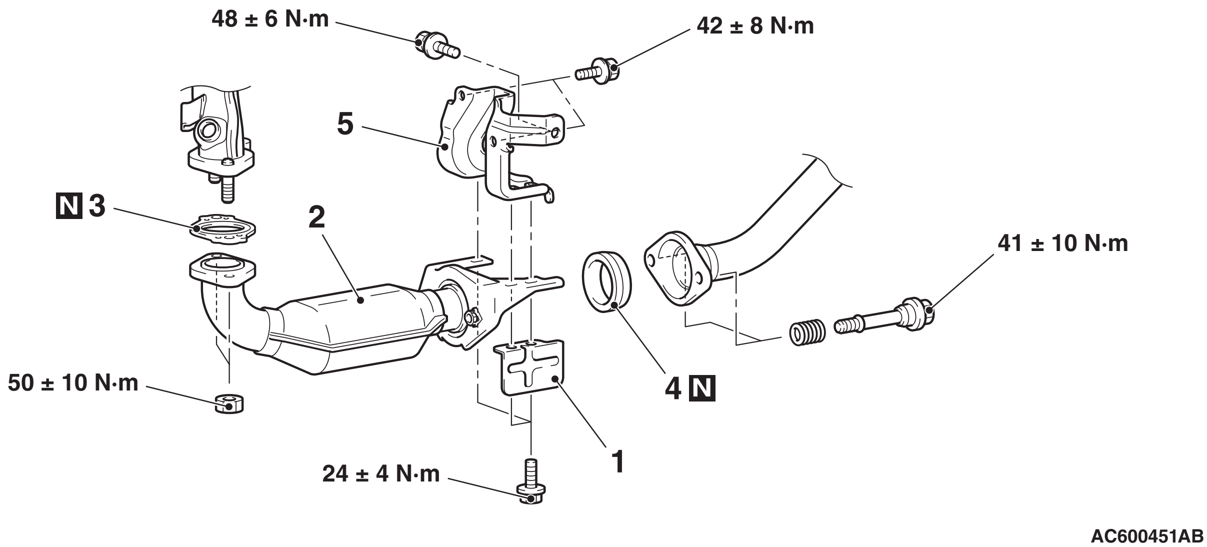
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CATALYTIC CONVERTER

REMOVAL AND INSTALLATION <4G1>

M1173003900977

<FRONT CATALYTIC CONVERTER>



Removal steps

1. Protector
2. Front catalytic converter assembly
3. Gasket

Removal steps (Continued)

4. Seal ring
5. Bracket